PATENT SPECIFICATION

592,538

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(Under Section 6 (1) (a) of the Patents &c. (Emergency) Acts, 1939, the proviso to Section 91 (4) of the Patents and Designs Acts, 1907 to 1942 became operative on April 20, 1945).

COMPLETE SPECIFICATION

Improvements in Projectiles of Small Calibre

We, LUMALAMPAN AKTIEBOLAG, a Company organized under the Laws of Sweden, of Södra Hammarbyhamnen, Stockholm, 20, Sweden, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

As ammunition for fire-arms of small calibre, such as rifles and machine guns, projectiles fitted with outer casings are generally used. It has been possible to make these projectiles armour-breaking by the insertion in the outer coating of a core of hard material consisting, for example, of some special kind of hardened steel, or some hard alloy, as tungsten carbide, sintered together with cobalt as a binder. According to designs suggested long ago, the armour-breaking core is then adapted, with regard to shape and dimensions, to fill up, along the greater part of its length, the outer casing. Its centric position in the outer casing is mainly ensured by the tight fitting of its surface, particularly of its cylindrical section, to the inside surface of the outer casing. It is apparent that the manufacture of such projectiles requires an extreme precision with regard to the outer casing as well as to the core, a precision very difficult to maintain, particularly in the case of cores the definite shaping of which is the result of a casting or sintering process. In order to minimize the excessive wear of the barrel caused by such hardcored projectiles it has further been found necessary to give the outer casing ample wall thickness, and usually also to make it of a heavy material, rendering its weight considerable. Another method also used is to make the core diameter slightly less than the inside diameter of the outer casing, and to fill out the space between the core and the casing with a soft metal, usually by slipping a leaden envelope over the core before the latter is inserted in the outer casing. As it is technically difficult to give this envelope a thin wall and at the same time make it fit exactly the core as well as the outer casing, a comparatively thick-walled envelope is commonly used. Its considerable weight makes the weight relation small between the armour-breaking part of the projectile and the rest of its mass, a weight relation disfavourable to the armour-breaking properties of the projectile.

According to further designs it is known to let a casing surround the core in such a way that the casing is spaced away from the core which only contacts one end of the casing, the other end being bent inwardly to engage the core. Even this construction requires extreme precision with regard to dimensions of the assembled parts of the projectile. This invention consists of a new arrangement for the supporting of a core in a casing spaced away from the core.

The projectile according to the invention consists of a core surrounded by a pointed outer casing, and is characterized by the fact that the core is rested in front directly against the inside surface of the pointed part of the casing and behind is rested against a body inserted in the casing, the core lying freely in the casing between these end supports over the major part of the core. In particular the invention is intended to be applied to projectiles with armour-breaking cores, but it is not limited to such designs.

The disadvantage already referred to as inherent in armour-breaking projectiles with a thick-walled outer casing, or with a leaden envelope, consisting in a disfavourable distribution of weight, inasmuch as the armour-breaking core has too small a share in the total weight of the projectile, has been eliminated in the projectile now suggested partly by admitting the use of a light and thin-walled outer casing, and partly by the possibility afforded to dispense entirely with the heavy leaden envelope. With the new projectile it is therefore possible to concentrate most of its weight to the armour-breaking core. The projectile now suggested also makes

[Price

it possible to give the outer casing a design that will minimize the air resistance without interfering with the design of the core. Thus the design of the core can be elaborated mainly in consideration only of maximum piercing efficiency, while a shape suitable for precision mounting is at the same time chosen. The ogival form given the front part of the outer casing is utilized directly, according to the invention, for the exact centreing of the front end of the core in the outer casing, an advantage of particular value where projectiles are concerned which have been manufactured by casting or sintering, because only their front and possibly rear parts need be finished with greater precision.

The projectile now suggested also presents solutions to many manufacturing problems mentioned above. Thus the exclusion of the leaden envelope implies the saving of a material difficult to procure and for which a substitute could not easily be found. Other advantages will be accounted for in connection with the description of some different designs shown in Figures 1—4 of the accompanying drawing.

Figure 1 shows a projectile the outer casing of which surrounds a core 2 resting with its pointed end against the inside surface of the outer casing along the circumference 3 marked by a dotted line, and being held in its rear part by a circumferential constriction 4 of the outer casing. This constriction or impression, if conveniently placed and designed, can also be utilized for the fixation of the projectile in the cartridge-case. The projectile further comprises a supporting body 5 made of a soft material and hereinafter termed "shoe". The object of this shoe is twofold: to fix the position of the core in the outer casing, and to take up such variations in the core length as are met in the practical manufacture of cores, especially if casting or sintering processes are applied. Since the core should make up the greater part of the weight of the projectile, a very light material is preferable for the shoe, in which case also the centre of gravity of the projectile is moved forward and, as a result, the piercing power of the projectile, particularly for oblique angles of impact is improved.

It is desirable, especially where automatic machinery is used, to exert a comparatively high pressure in mounting the core and the shoe, and if projectiles according to Fig. 1 are concerned it easily happens that the outer casing, particularly if it is thin, is deformed in the region where the pointed part of the core presses against the outer casing, the contact surface being small. For this reason it is advisable to design the pointed part of the core with a conical sloping 6, as shown in Figures 2, 3 and 4, so as to enlarge the contact surface between the pointed part of the core and the outer casing. This design of the point with a conical surface of support presents the additional advantage of enabling the core to centre itself almost perfectly when being inserted in the outer casing, an advantage particularly important where the mounting method used implies the subsequent insertion of the shoe.

In the design shown in Fig. 3, the shoe 5 is shaped with a recess 7 the edge of which surrounds the rear part of the core. In consideration of possible diameter variations occurring in the manufacture of cores, this recess can be made slightly conical. The rear part of the core is then centred very exactly in the outer casing.

However, if cores of so great a diameter are used as to practically fill up the outer casing, the centration can hardly be effected in this manner. The part of the shoe surrounding the rear part of the core would then have to be very thin and at the same time consist of a very soft material, requirements presenting technical difficulties. In this case it is expedient, as indicated in Fig. 3, to provide the rear part of the core with a tapering termination 8 which can be utilized in centreing the core, the shoe being shaped with a corresponding concavity. In order to facilitate the mounting of the parts it is advisable to provide the shoe with a similar concavity in its opposite end, too. This will make it possible to fit any of the two ends to the core, a possibility facilitating the manufacture, particularly where it is automatic. Such a rear concavity further facilitates the constriction of the back part of the outer casing, an operation usually performed before the back edge of the outer casing is folded.

In the examples described above the shoes have been made up of solid bodies, preferably of a soft material. As is visible from the projectile according to Fig. 4, however, the shoe can also be made hollow, in the shape of a tube or a sleeve, for instance. If the walls are made thin, the shoe will obtain sufficient elasticity to ensure a small wear of the fire-arm, even if a comparatively hard material is used. The use of a hard material for the shoe makes it possible, besides, to improve the centreing of the rear part of the core, which can conveniently be shaped as a cone frustrum 10 as shown in the Figure. The cavity can be utilized for a trace charge in which case the sleeve, if a sleeve is used for the shoe, is provided with a

rear opening 11. As is visible from the designs shown in Figures 3 and 4, the positions of the cores are fixed by means of two opposite cones 6 and 8, 6 and 10, respectively. This system offers an advantage not mentioned before, particularly in the case of cores produced by sintering. In this production it is difficult to maintain a constant diameter of the cores unless resorting to expensive working methods. In consideration of the divergence of the projectiles it is desirable to maintain the weight of the cores constant, involving a variation of the length of the core in the relation of inverse proportionality to the squared diameter. The fixing of the cores, according to the invention, in the outer casing by means of two conical guiding appliances will bring the centres of gravity into approximately the identical position in the cores, provided that the cone angles have been correctly adapted to the actual variations in lengths and diameters. A thin and long core will evidently slide further into the outer coating than a short and thick one. Similarly, the rear edge of the shoe will always have the same distance from the pointed end of the outer casing, a feature facilitating the mounting. It is also possible to use designs with a core provided at its rear end with a central concavity of conical, spherical or similar shape, the shoe being then designed with a projection adapted to enter this concavity. The designs shown in Figures 3 and 4 are superior, however, inasmuch as here the shoe is guided along a considerable length by the outer casing. This is important for a reliable guiding of the rear end of the core in the outer casing, but above all it is valuable for the guiding of the projectile in the barrel. The function of the shoe as a support for the outer casing when engaged by the rifling of the barrel, is of great importance, especially if the outer casing is thin-walled. The efficiency of this support from the shoe to the outer casing will of course increase with the length of the shoe, but it is additionally increased by the designs of the core and the shoe shown in Figures 3 and 4. Owing to the rear conical form of the core, the front edge of the shoe is pressed out against the outer casing when the projectile is being mounted, and the outer casing is thus very efficientiy supported at this place.

As stated already in this description, it is an advantage to use a light material for the shoe. If the shoe is made extra light, due attention being given to the choice of material as well as to the design, it is possible where a core of an hard metal alloy or another heavy material is used, to effect a considerable displacement of the centre of gravity in the forward direction. In projectiles according to Figures 3 and 4, for example, where the core can be made exceptionally short and thick, the centre of gravity of the projectile can even be placed in front of the geometrical centre, no matter if the projectile is adapted externally to the advanced streamline shape nowadays commonly used for high velocities. As material for the shoe, aluminium may be recommended, because in its pure state this material is also very soft and plastic. If the shoe is made hollow, as indicated in connection with Fig. 4, a cheaper material can also be used, such as iron or other metals of comparatively great hardness. If the core consists of a material of very high specific gravity, a leaden shoe can be used without detriment to the good properties of the projectile.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Projectile, especially for fire-arms of small calibre, with a core surrounded by a pointed outer casing, characterized by the fact that the core is rested in front directly against the inside surface of the pointed part of the casing and behind is rested against a body inserted in the casing, the core lying freely in the casing between these end supports over the major part of the core.

2. Projectile according to claim 1, characterized by the fact that the forward end of the core is designed with a conical sloping with which the core rests against the inside surface of the casing point.

3. Projectile according to claim 1 or 2, characterized by the fact that the inserted supporting body serves as a centreing medium for the rear part of the core.

4. Projectile according to claim 1, 2 or 3, characterized by the fact that the rear part of the casing is provided with a circumferential constriction or impression for the centreing of rear part of the core in the casing.

5. Projectile according to any of the preceding claims, characterized by the fact that the inserted supporting body is designed as a tube or sleeve surrounding completely or partially the rear part of the core.

6. Projectile according to claim 5, characterized by the fact that the rear part of the core is provided with a conveniently conical projection or end surface to which the supporting body is fitted.

7. Projectile according to any of the preceding claims, characterized by the fact that the inserted supporting body consists of a light and soft material.

8. Projectile according to claim 7, characterized by the fact that the inserted supporting body consists of aluminium.

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Fig. 1

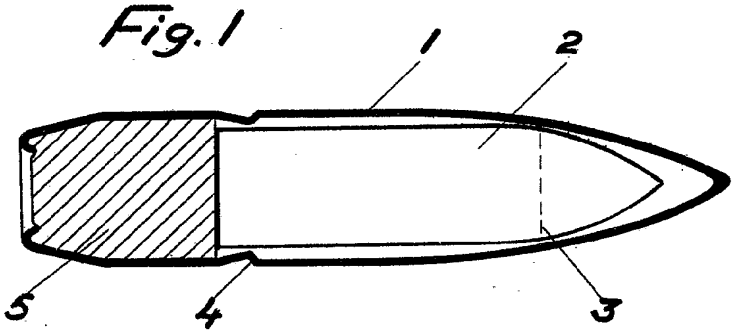


Fig. 2

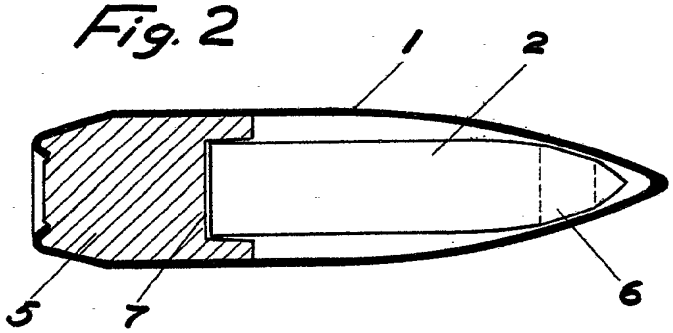


Fig. 3

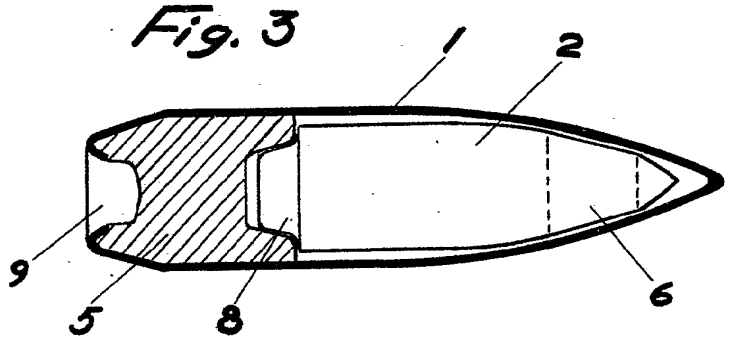
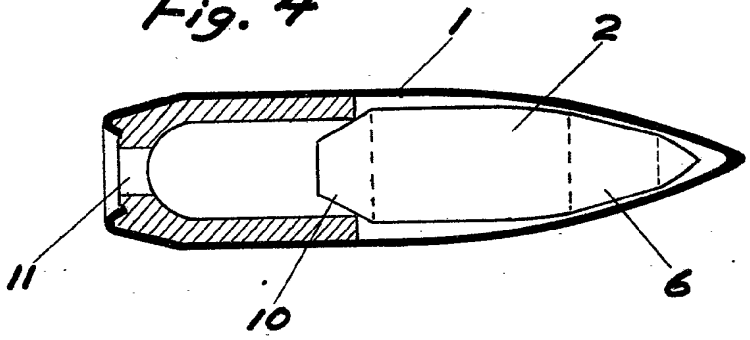


Fig. 4



H.M.S.O.(Ty.P.)